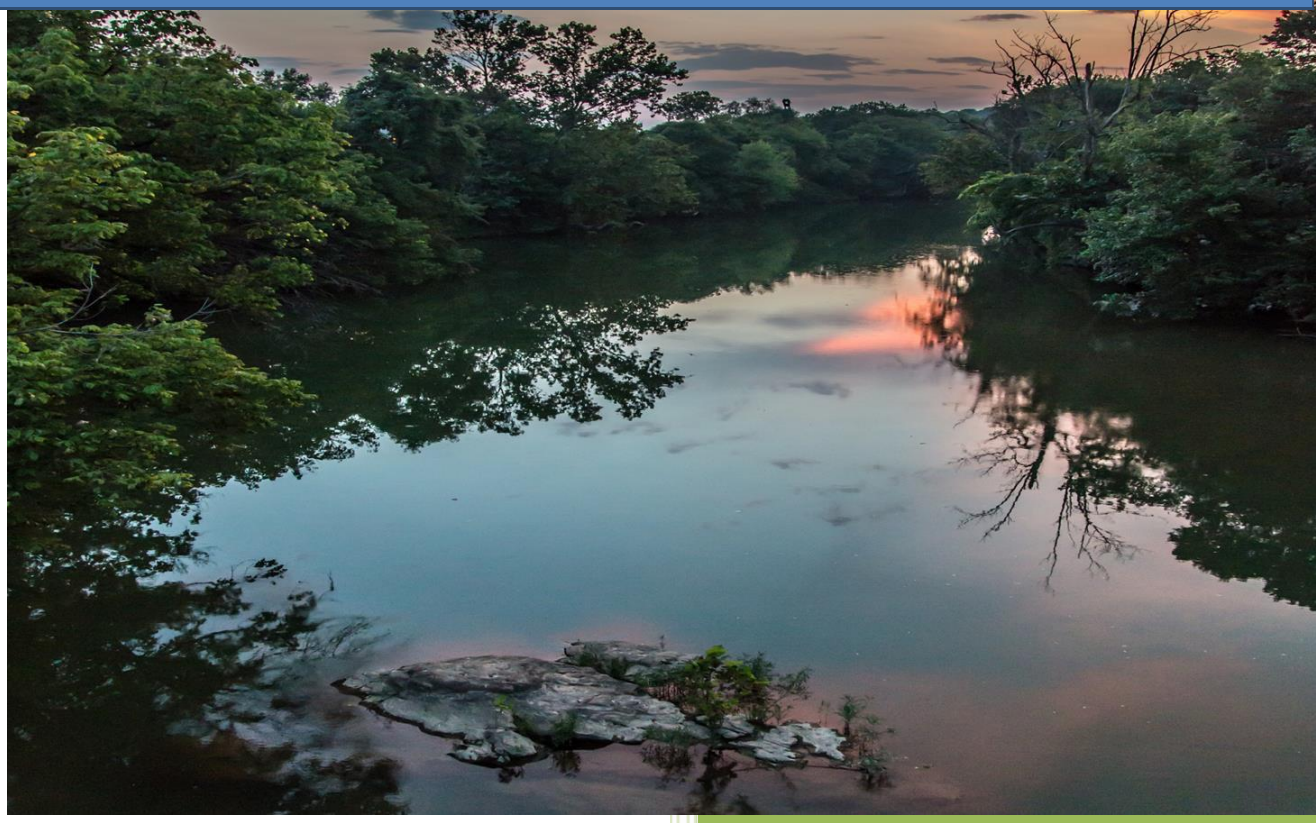
Submitted to:

The Virginia Department of Environmental Quality

Blue Ridge Regional DEQ Office
MS4 Stormwater Permitting Division
901 Russell Drive
Salem, VA 24153

City of Roanoke Sediment and Bacteria TMDL Action Plan



Effective July 1, 2015
Updated Sept. 24, 2021

ROANOKE
STORMWATER

Stormwater Utility
Public Works Service Center
1802 Courtland Road, NE
Roanoke, VA 24012

TABLE OF CONTENTS

SECTION 1: BACKGROUND

1.1 ESTABLISHED TMDL'S AND WLA'S

Bacteria Total Maximum Daily Loads (TMDLs) have been created for the following tributaries in the Upper Roanoke River Watershed: Carvin Creek, Glade Creek, Laymantown Creek, and Lick Run which all flow into Tinker Creek. Additionally, Wilson Creek, Ore Branch, and the Roanoke River are impaired by bacteria and have established TMDLs. The Roanoke River also has an established TMDL for Benthic Invertebrates.

The following stream assessments were included with the Roanoke River TMDL Implementation Plan as nested segment impairments and are applicable to the City: Mason, Mudlick, Murray Run, and Peters Creek.

- MapTech, Inc., Virginia Tech Crop & Soil Sciences, and Roanoke Valley-Alleghany Regional Commission. (March 2004). *Fecal Coliform TMDL Development for Glade, Tinker, Carvin, Laymantown, and Lick Run*. Retrieved from: http://www.deq.virginia.gov/portals/0/DEQ/Water/TMDL/apptmdls/roankrvr/tinkerfc.pdf

- George Mason University and Louis Berger Group, Inc. (February 2006). *Bacteria TMDL for Wilson Creek, Ore Branch and Roanoke River Watersheds.* Retrieved from: http://www.deq.virginia.gov/portals/0/DEQ/Water/TMDL/apptmdls/roankrvr/uroanec.pdf

- Lewis Berger Group, Inc. (March 2006). *Benthic TMDL Development for the Roanoke River, Virginia.* Retrieved from: http://www.deq.virginia.gov/portals/0/DEQ/Water/TMDL/apptmdls/roankrvr/uroanbc.pdf

- Lewis Berger Group, Inc. (April 2015). *Roanoke River Bacteria and Sediment TMDL Implementation Plan*, Appendix A. Retrieved from: http://www.deq.virginia.gov/Portals/0/DEQ/Water/TMDL/ImplementationPlans/Drafts/Upper_Roanoke_Draft_IP. pdf

Verified 9/24/2021:
https://public.deq.virginia.gov/WPS/BRRO/Lewis%20Permit%20files/KOPPERS%20VA0001333/2015/FS/Benthic%20TMSL%20exec%20summary.pdf

The following table provides a summary of the Waste Load Allocations (WLAs) that are under the jurisdiction of the City MS4. These figures represent the portions of the specified surface water body that fall within the municipal boundary of the City of Roanoke (henceforth referred to as the "City").

Surface Water Body	Benthic Macro-Invertebrate - Sedimentation WLA	% Reduction Needed	EPA TMDL Approval Date	Bacteria - E.coli WLA	% Reduction Needed	EPA TMDL Approval Date
Roanoke River	953 tons/ yr	69.5%	05/10/2006	1.93E+11 cfu/yr	98.8%	08/02/2006
Tinker Creek				2.24E+12 cfu/yr	98%	08/05/2004
Carvin Creek				1.04E+12 cfu/yr	98%	08/05/2004

Glade Creek				1.13E+11 cfu/yr	98%	08/05/2004
Lick Run				6.84E+10 cfu/yr	98%	08/05/2004
Ore Branch				2.02E+10 cfu/yr	99.5%	08/02/2006

Impaired streams without a separate TMDL study and identified MS4 WLA were added as nested segments in the Roanoke River Bacteria and Sediment TMDL Implementation Plan. These load allocations (LAs) labeled as "nested" reference non-point pollution sources throughout the entire identified watershed.

Mason Creek		4.42E+12 cfu/yr (nested LA)
Peters Creek		1.50E+12 cfu/yr (nested LA)
Mudlick Creek, Murray Run, and Ore Branch		8.59E+11 cfu/yr (nested LA)

1.2 SIGNIFICANT SOURCES OF POLLUTANTS OF CONCERN (POCs) OWNED BY THE OPERATOR

As part of the City's Virginia Pollutant Discharge Elimination System (VPDES) permit requirements for Permit Year 2012-2013, a list was compiled of all City properties, and then examined to determine which properties may contain the potential for releasing TMDL priority pollutants (bacteria & sediment). The list is mostly office buildings and park structures with no significant sources of priority pollutants; the exception is the Public Works Service Center which houses field operations that were identified as having the potential to release pollutants.

The Public Works Service Center (PWSC) at 1802 Courtland Road, NE serves as a base of field operations for many City functions including the Transportation, Stormwater and Solid Waste Management Divisions within the Public Works department and the Fleet Management and Facilities Management Divisions within the General Services Department. Also included are the Parks Division of the Parks and Recreation Department and the Radio Technology Division of the Department of Technology.

The 12.5 acre PWSC campus houses operations for all elements of public right-of-way maintenance, solid waste and recycling collection, City-owned facility maintenance, City-owned fleet maintenance and park maintenance. The PWSC also houses bulk petroleum storage; participates in bulk petroleum transfer; and open stores mulch, sand, and similar aggregate materials; fertilizer, insecticides, and pesticides; waste paint; and generation of other hazardous wastes. Additionally, solid waste trucks parked on site contribute to the potential of solid waste leachate and other parked vehicles may contribute to residual fluids on pavement. These combined risks have led to the identification of this property as potential sources for priority TMDL pollutants.

In the permit year 2014-2015, the City added two dog parks as significant sources due to the potential for larger than normal bacterial contamination loads. Thrasher Park has a fenced, leash free acre-sized dog yard, which is located within both Tinker Creek and Glade Creek watersheds and is geographically closer to Glade Creek. HighlandPark also features a leash free acre-sized dog yard and is in close proximity to the Roanoke River. No additional areashave been identified.

SECTION 2: OPERATOR EFFORTS AT REDUCING POLLUTANT LOADS

2.1 LEGAL AUTHORITIES

2.1.1 Stormwater Management Ordinances – City Code Chapter 11

Primary TMDL Target: Sediment and E. coli bacteria.

Chapter 11.3 – Stormwater Discharge Requirements

This chapter of City Code provides controls to prevent illicit discharges of pollutants into the stormdrain system as mandated for the City's MS4 permit under the National Pollutant Discharge Elimination System (NPDES) and Clean Water Act.

Section 11.3-4 includes language to prohibit discharge of any method and material whether purposeful or accidental and prevents illegal connections to the stormdrain system.

Section 11.3-5 gives the City the authority to inspect and monitor the stormdrain system to determine compliance including testing at illicit discharge sites.

Chapter 11.5 – Stormwater Utility

This chapter of City code created the City's Stormwater Utility and took effect on July 1, 2014 with the intent to provide dedicated resources to operate and maintain the City's stormwater drainage system, improve water quality, and comply with the legal requirements of the City's MS4 permit.

Additionally, the Stormwater Utility is to address drainage challenges by designing, managing and implementing capital improvement design projects in combination with best management practices that address effective stormwater movement and flooding concerns while improving water quality.

Chapter 11.6 – Stormwater Management

This chapter of City code was created to minimize and mitigate the adverse effects of land development. The City Ordinance, under the new Chapter 11.6 entitled *Stormwater Management*, outlines the technical criteria for developing Stormwater Pollution Prevention Plans (SWPPPs) for some regulated land-disturbing activities. Land disturbing activities include development or redevelopment projects with a disturbed area of 10,000 sq. ft. or more. These permit-based activities are subject to plan review, construction inspection, as-built plan review, maintenance requirements, and long-term inspection to ensure proper function of BMP's. The Stormwater Management Ordinance gives the City authority to enforce requirements by issuing notices of violation, stop work orders, fines and civil penalties. The Stormwater Management Design Manual provides standards to successfully abide and implement the City's Stormwater Ordinance.

Implementation Schedule and Key Milestones:

- FY 2014-2015 – City Code Chapter 11.6 - Stormwater Management Ordinance was fully revised to reflect new VSMP requirements and went into effect July 1, 2014.

- FY 2014-2015 – City Code Chapter 11.5 - Stormwater Utility was created to provide dedicated funding for stormwater management to protect the general health, well-being and safety of the City's residents and went into effect July 1, 2014.

2.1.2 Solid Waste Ordinance – City Code Chapter 14.1

Primary TMDL Target: Sediment and E. coli bacteria.

This chapter of City code promotes public awareness and education about all aspects of Solid Waste Management including acceptable and unacceptable solid/hazardous waste materials for collection. Dumping of solid wastes within the City limits is prohibited at any place not designated by the City. Littering, as a form of dumping is also strictly prohibited.

Chapter 14.1 also mandates that fats, oils, and grease resulting from food preparation must be kept at all times in a tamper resistant, watertight, stationary, and anchored container. The container and surrounding area must be kept clean and sanitary while spillage or leaks of the fats, oils or grease from the container must not be allowed to enter the right-of-way or stormdrain system. If a spillage incident occurs, the owner or occupant must notify emergency management by calling 911.

Further, the City arranges to hold special dates for bulk & brush collection and bagged leaf collection.

Finally, the City is a member of the Roanoke Valley Resource Authority (RVRA) which handles all household hazardous waste. As a result of the City's membership, its residents are able to dispose of chemical wastes at the RVRA site on every 3rd Saturday throughout the year. The RVRA is located at 1020 Hollins Road, Roanoke, VA.

Implementation Schedule and Key Milestones:

Centralized Waste Compactors:

- Existing - The City operates 5 centralized waste management compactors located within our downtown central business district. The compactors provide for all necessary solid waste containment and disposal needs of downtown residents and commercial facilities in discrete centralized locations that are equipped with security cameras and radio frequency identification (fob) controlled access. This program has greatly reduced the amount of solid waste and related liquid run-off that previously occurred with decentralized curbside collection of bagged waste, thereby reducing sediment and bacteria pollution. There is no further curbside trash or recycling collections within the majority of the central business district. Solid Waste continues to work with Downtown Roanoke, Inc. (DRI) to purchase and install enclosed pedestrian litter containers downtown as needed. DRI is the entity responsible for coordinating andfacilitating commerce in our Central Business District. *Note that restaurants are still required to maintain their own waste fats, oils and grease recyclingfacilities per City Code.

Single Stream Recycling:

- Existing – The City began Single Stream Pick-up of household recyclables on October 5, 2015. In 2016, the City made available a Recycle Coach App to help citizens track collection dates based on addresses, set calendar reminders for collection dates, holiday schedule changes, and a disposal database of what items can be recycled in our area.

- FY 2020 -The Recycling Coach App has 12,755 users, 3,215 subscribers are receiving reminders, and there have been a total of 102,492 interactions this fiscal year to date. The City of Roanoke Solid Waste website has been updated and now the Recycling Coach App is compatible with Google Assistant.

- FY 2021 – The Recycling Coach App has 24,049 users, 3,898 subscribers are receiving reminders, and there have been a total of 103,401 interactions this fiscal year to date.

Leaf and Bulk Waste Collection:

- Existing - On October 5, 2015 the City initiated a weekly collection of brush and bulk waste. Leaf collection postcards are mailed to all city residents with fall pick up dates annually. Information is also available on the Solid Waste's website. If residents can pick brush up with two hands, they place items in the Big Blue trash bins, otherwise they are picked up as bulk waste.

Fats, Oils and Grease (FOG):

- Existing – City Departments including Solid Waste, Office of Environmental Management and the Stormwater Utility, along with Downtown Roanoke Inc. continue to work to enhance restaurant grease management in the Central Business District (CBD). The restaurants have been mapped and reviewed in conjunction with existing inlet stenciled messaging.
    - FY 2020-2021 New locations in the CBD have been identified where additional inlet marking could take place.
    - FY2022-2023 Work with CVC to implement additional marking.

- Existing – The Solid Waste Ordinance was updated to more directly address the FOG wastestream and to reduce incidents of FOGs as a stormwater pollution source in sections c-e under Chapter 14.1-54.1.

- FY 2019 – The Parks and Recreation Division updated their *Facilities Rules and Regulations* to further address ground protection, spills, and misuse of stormdrains at public events.

- FY 2019 - FY2023 – The FOG brochure was initially mailed out to all City restaurants. Currently brochures will be mailed out to new restaurants as well as distributed by Fire Marshals during inspections. Stormwater also continues to work with Downtown Roanoke Inc. and the OEM to educate downtown restaurants to reduce FOGs as Stormwater pollution sources. Events downtown are encouraged to exercise the "leave no trace" motto.
    - FY2021 – The Fire Marshall's office handed out approximately 150 brochures. City wide mailing was delayed to FY22 due to COVID-19.

- FY 2020 - Develop partnerships to receive accurate records of new restaurant listings each year to facilitate the creation of a mailing list for FOG brochures. FY2021 - The restaurant list will be acquired from the City real estate GIS records each year for the mailing.

2.1.3 Sewers and Sewage Disposal Ordinance – City Code Chapter 26

Primary TMDL Target: All pollutants including Sediment and E. coli bacteria.

This chapter of City code authorizes The Western Virginia Water Authority (WVWA) to provide water, sewer service, and sewage treatment to the residents of the City.

Chapter 26-1.1. - Sewer use standards of the Western Virginia Water Authority including sewer connection and acceptable hook-up standards.

Chapter 26-11. - Discharge of contents of septic tank cleaning trucks into sanitary sewer

Chapter 26-45. - Prohibited discharges

2.1.4 Zoning Ordinance – City Code Chapter 36

Primary TMDL Target: Sediment and E. coli bacteria.

Chapter 36.2-335 - River and Creek Corridors Overlay District (RCC)

This section of the City's zoning ordinance recognizes the value of the Roanoke River and its tributaries and designates a level of protection for riparian buffers, thereby supporting the natural functions that riparian buffers provide. A riparian buffer must be 50' in width as measured horizontally on a line perpendicular to the surface water, landward from the top of the bank on each side of the river or tributary and every effort must be made to retain and support indigenous vegetation. The district imposes restrictions on plant removal, clearing and grading, as well as, land uses and development activities. The riparian buffer district is required to be clearly marked on-site prior to any land disturbing activities and remain in place throughout the duration of the project. This district works in conjunction with base zoning district regulations and the Floodplain Overlay District.

Implementation Schedule and Key Milestones:

- FY 2015-2016 – Stormwater reviewed the River and Creek Corridors (RCC) Overlay to identify gaps in coverage.
- FY 2020- 2022 – The Stormwater Division continues to work with the Planning Department regarding the potential expansion of the RCC Overlay District to include all parcels adjacent to a surface water body (see WMP Summary Table: Goal 1(A-D). Other goals include:
    - Scale-appropriate buffer protection for all City perennial waterways and prevention of additional perennial stream burial
    - Stormwater to review and make RCC comments on all relevant development plans
    - Update policy on stream dumping being considered a class I misdemeanor
- FY 2022 - Upon concurrence between Stormwater and Planning, an updated RCC would go to City Administration for review and comment and upon approval may be considered by City Council for adoption.

Chapter 36.2-333 - Floodplain Overlay District

This section of the City's zoning ordinance outlines mandatory floodplain restrictions for FEMA compliance and additional standards to restrict impervious surfaces within the floodplain, ultimately reducing threats to loss of life

and property and optimizing water quality. All development within the floodplain must be issued a zoning permit by the Zoning Administrator and include a standard FEMA elevation certificate by a licensed surveyor or engineer. The floodplain district allows for the storage of materials and equipment provided that they are not buoyant, flammable, or explosive and that such material shall be firmly anchored to prevent floatation or movement.

Implementation Schedule and Key Milestones:

- Existing – The City's Floodplain Overlay District is available online.

2.1.5 Right-of-Way Excavation Permits – City Code Chapter 30

Primary TMDL Target: Sediment

Chapter 30 – Article III – Street Excavations

This article of City code chapter 30 requires a permit to be obtained before any excavation or opening in the pavement surface of any City street, alley or public right-of-way. The permit requires that Stormdrain inlets be protected during work; that no excavation may be left uncovered at night; and that the excavation must be fully restored in accordance with City Right-of-Way Excavation Permit standards.

2.1.6 Assembly & Street Vending Permits – City Code Chapter 30

Primary TMDL Target: Sediment and E. coli bacteria

Chapter 30 – Article VI – Permit for Public Assemblies and Sec. 30-9.2.- Street Vending

These sections of City code chapter 30 require a permit to be obtained before conducting a public assembly on any public street, sidewalk, alley or other portion of the public right-of-way, or in any public park or on any public property. Further, section 30-9.2 requires vendors to obtain a permit before vending food or beverages, or both, either within city rights-of-way or on city-owned properties, including, but not limited to, public parks and greenways. Permits require a trash receptacle within 20' of site if a public receptacle is not available. Collection and daily waste removal to a proper receptacle is also required. Location of trash receptacles should not obstruct pedestrian and vehicular flow nor should they present a hazard to general public health, safety and welfare.

Liquid wastes including, but not limited to, grease, oil, trash, washing and sanitizing water must be collected, managed, and disposed of properly in a liquid waste tank or septic collection service to avoid accidental spills and contamination of the City stormdrain system.

2.2 PRACTICES, TECHNIQUES, AND DESIGNS

2.2.1 Streetsweeping

Primary TMDL Target: Sediment and E. coli bacteria.

The streetsweeping program is an integral part of the City's sediment and bacterial reduction plan, because we

recognize the association between bacteria and sediment loading in the Roanoke River and its tributary watersheds. The City's streetsweeping section also collects animal carcasses to reduce bacterial contamination and health concerns.

The City's streetsweeping monthly program covers 1459 lane miles as outlined below. The goal is to complete 12 cycles for the residential and arterial streets every year. The Central Business District completes a cycle nightly. Factors such as weather, changing seasonal conditions and equipment performance affect how closely this schedule can be followed. Tonnage of sediment and debris removed is recorded prior to disposal at Roanoke Valley Resource Authority.

Implementation Schedule and Key Milestones:

- Existing - The streetsweeping schedule was enhanced over the 2013-2018 permit cycle. The overall schedule is as follows:
    - Clean each residential street monthly (901 lane miles/cycle)
    - Clean arterial streets monthly (158 lane miles/cycle)
    - Clean the Central Business District (CBD - downtown) streets nightly (except Christmas) (20 lane miles/cycle)

- FY 2020-21 Stormwater is adding one Elgin Crosswind streetsweeper and two new trucks to pick up large debris.

Streetsweeping Program Progress

Program Year	Residential Cycles Completed	Arterial Cycles Completed	CBD Cycles Completed	Actual Tons Removed
FY 2016	5	✓	✓	1299.17
FY 2017	8	✓	✓	1444.84
FY 2018	7	✓	✓	2031.66
FY 2019	10	✓	✓	2,532.00*
FY2020	10.5	✓	✓	1737.24
FY2021	11.5	✓	✓	1529.18

*Tons removed via streetsweeping and stormdrain cleaning in fiscal year 2019

2.2.2 Stormdrain System Maintenance

Primary TMDL Target: Sediment and E. coli bacteria.

The City purchased an additional Vactor truck during FY 2015-2016 for a total of two Vactor trucks in service. The new CCTV trucks have allowed considerable progress to be made on stormdrain system inspections with an average length of 759 ft/day. These Vactor trucks will be used to remove sediment and debris from the 7593 existing stormdrain inlets and 422.64 linear miles of existing stormdrain pipe. This BMP aids in reducing the floatables, sedimentation and other pollutant sources before they reach the 711 stormdrain outfalls that flow directly into the Roanoke River and its tributaries.

The City's stormdrain maintenance crews are equipped with two CCTV Inspection trucks that can be used to identify and gain more information on any stormdrain and pipeline issues, including investigating illicit discharges.

The City's stormdrain maintenance crews are updating the stormdrain asset inventory and concurrently verifying the City's stormdrain GIS layer data using an iPad ArcGIS Collector App. GPS-enabled technology readily identifies stormdrain features on GIS including manholes, pipe orientation, termination points and outfalls. The watershed asset inventory verification is in conjunction with the development of the City's individual tributary Watershed Master Plans.

Implementation Schedule and Key Milestones:

- FY 2019-2023 Asset Inventory Goal: Inventory will be completed for all other watersheds within City limits: Barnhardt Creek; Murray Run; and the Roanoke River. The City has been split into 271 equal sized grids, the goal is to complete the inspection, inventory and needed cleaning of all stormwater assets for 30 grids per year. This schedule would result in the completion of all 271 grids Citywide within a 10 year period.

Watershed	Completed
Lick Run	September 2015
Tinker, Glade, and Carvin	June 2016
Trout Run	July 2017
Peters Creek	July 2018
Ore Branch	July 2021
Mudlick, Murdock	July 2022 (In progress)

- FY 2021-2023 CCTV Inspection Goal: 30 grids per year, (previous permit-cycle goal: 90,000-120,000'). CCTV staff has also moved to a shift of four, ten hour days instead of five, eight hour work days to maximize workable time to complete inspections.

- FY 2020-2022 - Shorter, more complex stormdrains continue to be inspected for better accuracy.

- FY 2021-2022 - Stormwater is considering an update to older CCTV equipment and/or investment in a new CCTVcamera system to increase the number of inspected linear feet per year in order to reach the goal of 30 grids per year.

Date	Linear Feet Inspected
FY2016	73,099
FY2017	331,927
FY2018	130,780
FY2019	41,879
FY2020	110,441
FY2021	93,429

- FY 2018-2023 Stormdrain Cleaning Goal: Inspect 100-200 inlets/year. Repairs and ditch lines cleaned as needed.

Date	Cleaned/Inspected	Repairs	Ditch Lines
FY2018	1,111 stormdrains inspected, 97 cleaned.	100 inlets.	n/a
FY2019	21,676 linear ft of pipe cleaned. 109 drains unclogged.	60 drains/manhole repaired.	64
FY2020	102 inlets and 50,267 linear ft of pipe cleaned.	54 inlets	60
FY2021	78 inlets and 47,741 ft of pipe cleaned.	55 inlets	54

2.2.3 Illicit Discharge Detection and Elimination (IDDE)

Primary TMDL Target: All pollutants including E. coli bacteria and Sediment

As a part of the City's MS4 permit and in compliance with MCM#3, the City's Office of Environmental Management (OEM) oversees IDDE activities. This program completes field screenings to identify potential illicit discharges during dry weather on a minimum of 50 outfalls annually by permit year. The program follows through on any potential or confirmed illicit discharge or illegal connections through established Standard Operating Procedures (SOP) for response and enforcement of the IDDE ordinance and process for tracking violations and actions taken.

Implementation Schedule and Key Milestones:

Outfall Inspections

- Existing – Outfall inspections are conducted using an automated Survey123 form on iPads and then saved to the City's network.

- FY 2018 - 2023 – To maintain optimal outfall mapping accuracy, Stormwater's GIS specialist will manually control outfall classification in the GIS system.

Monitoring

- Existing - FY 2023 – The OEM uses testing equipment to measure detergents, ammonia, and pH during illicit discharge investigations. The goal is to engage in real-time field analysis for faster illicit discharge resolution.

    - Existing – In FY 2018, Stormwater purchased a multi-parameter probe that measures 12 criteria. Stormwater uses the probe monthly at bacteria monitoring locations. It is available to the OEM during ID investigations.

- FY2017-2023 – Priority outfalls, identified in completed Watershed Master Plans are under review in the planning process to be monitored in addition to the 50 sites (WMP Summary Table: Goal 2, C).

- Existing - FY2023 – Stormwater staff collaborates with OEM's IDDE task by using the bacteria monitoring program. Stormwater is able to test suspect sites for E.coli as part of an IDDE investigation. As well as utilize their sampling plan with HRSD (Section 2.2.9) to test for human marker HF183 to identify a human waste issue. FY-21 – Human marker sampling capability is suspended from lack of sampling availability due to COVID-19.

2.2.4 Public Works Service Center Standard Operating Procedures

Primary TMDL Target: All pollutants including E. coli bacteria and Sediment

The City has developed Standard Operating Procedures (SOP) for the PWSC. The latest version was updated in 2019. This SOP establishes a directive for the utilization of BMPs that prevent or mitigate any environmental impacts to the stormdrain system that may occur as a result of daily operations at the PWSC. PWSC personnel must incorporate all applicable BMPs into their job functions.

Individual SOPs include:

1. Abandoned Waste SOP
2. Aggregate Storage SOP
3. AST Fuel and Fluid Transfer SOP
4. Cross Contamination SOP
5. Emergency Response Stations SOP
6. Facilities Hazard Exposure Control SOP
7. Handling Sharps and Blood Borne Pathogens SOP
8. Haz Mat Management SOP
9. Haz Mat Spill Response SOP
10. Oil-Water Separator Maintenance SOP
11. Ozone Depleting Substances SOP

12. Parking Lot Insp Sweep SOP
13. Parking Lot, Roadway, & Bridge Maintenance SOP
14. Pesticide and Fertilizer Application SOP
15. Pesticide and Fertilizer Storage SOP
16. Power Washing SOP
17. PWSC Best Management Practices SOP
18. PWSC SAA Inspection Checklists
19. PWSC Spill Response Station Checklists
20. Regulated Waste Management SOP
21. Salt Brine Storage SOP
22. Salt Delivery and Storage SOP
23. Solid Waste Collection Vehicle Washing SOP
24. Solid Waste Ready Line Pollution Prevention SOP
25. Storm Filter Inspection and Maintenance SOP
26. Stormwater Drain Cleaning SOP
27. Stormwater Illicit Discharge Detection and Elimination SOP
28. Stormwater Outfall Surveillance SOP
29. Stormwater Sediment SOP
30. SWPPP Annual Comp. Compl. Eval SOP
31. Used Battery Recycling SOP
32. UST Bulk Fuel Delivery -Fleet SOP
33. UST Bulk Fuel Delivery_Facilities SOP
34. Vehicle and Equipment Fueling SOP
35. Waste and E-Waste Disposal and Recycling SOP
36. Waste Antifreeze Disposal SOP
37. Waste Light Ballast Disposal SOP
38. Waste Oil Disposal SOP
39. Waste Paint Disposal SOP
40. Waste Vehicle and OPE Batteries SOP

Implementation Schedule and Key Milestones:

- Existing - The Office of Environmental Management (OEM) leads annual PWSC lot walks with the Director of Public Works and the PWSC Division Managers to identify areas for improvement.
- Existing – PWSC SWPPP and updated SOPs are available to all departments.
- FY2020-FY2021 – Stormwater and OEM collaborated on a roads, streets, and parking lotmaintenance SOP
    - FY2021 SOP finalized and included in the City's SOP list.
- FY2020 - FY2021 - Stormwater and OEM are continuing to work with other Division's Field Operations housed at PWSC to complete and return to SOP Inspection Forms to OEM for processing.

2.2.5 Oil & Grease Drip and General Clean Up at the City's Market Square

Primary TMDL Target: Sediment, including oil pollutants

The City pressure washes in the downtown Market Square area to remove oil and grease stains left by farmer's market vendor vehicles and temporary food service vendors.

Implementation Schedule and Key Milestones:

- Existing - Enzymatic cleaner trial is proving effective in spot treating smaller spots. More emphasis continues to be placed on stopping sources than reliance on clean up measures.

- Existing - In cooperation with DRI, the City implemented a proactive program requiring all market and food service vendors to place absorbent materials beneath all areas with potential for oil orgrease drips or spills.

- Existing – The City's Market Square began a program to quarterly pressure wash sidewalks and vendor canopies and steam food debris off the brick courtyard using water/steam. This will be executed by the Facilities Department. Inlet protection will be used as outlined in the SOP.

2.2.6 Use of Issue Tracking System (QAlert & VueWorks)

Primary TMDL Target: All pollutants including E. coli bacteria and Sediment

The City's QAlert system was established in 2014 as a database for customer service requests and is applicable to all departments. Service requests may be entered by either City field staff or by citizens via the QAlert iRoanoke App or by calling the City's customer service center at 853-2000. Service request types relevant to this Action Plan include: illegal dumping into stormdrains, pollution complaints, drainage complaints, including blocked stormdrains, ditches, etc. Once a service request is logged, the appropriate City party is notified via email or text to investigate. If the situation is the City's responsibility, either maintenance crews will address the request, or a stormwater engineer will review for possible addition to the Stormwater Capital Improvement Project program.

Implementation Schedule and Key Milestones:

- Existing - "If you see something, say something": The iRoanoke App, which creates a QAlert and routes it to the appropriate staff member, gives the public a method to report a potential illicit discharge or other stormwater related problem. Twitter is fully functional for use with the QAlert System.

- FY 2019 - 2023 – City has been working towards the implementation of the VueWorks Asset Inventory system and software to work with QAlerts. VueWorks is an asset management and work order system, it will enable us to better track our assets in the field and efficiently create and track work orders on all of those assets. City staff continues to work on configuring the system and inputting asset data.

2.2.7 Mutt Mitt Station Program

Primary TMDL Target: E. coli bacteria

The City provides pet waste stations at hotspot locations primarily in parks, along greenways, and downtown. Most locations are maintained 2-3x/week. Pet waste stations are also prominent at both dog parks and are restocked 3-4x/week. Additionally, new stations are installed as needed.

Implementation Schedule and Key Milestones:

- Exisiting – The Mutt Mitt Station Program added 2 additional stations over FY2021 for a total of 110 stations. Mutt Mitt station signs and waste receptacles are replaced as needed.

2.2.8 Green Infrastructure (LID Designs) for City Capital Improvement Projects

Primary TMDL Target: All pollutants including E. coli bacteria and Sediment

The City plans to increase the use of Green Infrastructure or Low Impact Development (LID) Design to achieve overall project effectiveness, support stream delisting, and make progress toward TMDL WLA goals while being cognizant of budgetary constraints. To that end, the City hosted an on-site Institute for Sustainable Infrastructure (ISI) Envision Certification training for applicable City staff, surrounding localities, and any interested local consultants. Further, Stormwater is adding new staff members dedicated to Green Infrastructure maintenance and construction.

Implementation Schedule and Key Milestones:

- Existing – Project designers will begin to become familiar with case studies, integrate optimal treatment chains where applicable and view projects within a watershed-based context. Project aesthetics will help with public buy-in of such projects and will be a consideration during project development.

- Existing – 7 staff members have received and maintained their ISI Envision Certification status.

- Existing – Stormwater has scored the past stormdrain capital improvement projects that the city has implemented using the ISI Envision rating system to measure the current level of sustainability of the stormdrain infrastructure system. This information will inform future capital improvement project designs; from assessing costs and benefits over the project lifecycle to evaluating environmental benefits and using outcome-based objectives.

    - ISI Envision CIP Rating Results Completed:

        - Roanoke Stormwater Benchmarks Capital Projects Using Envision

        - Envision Rating Report

    - FY 2019: A project has been designed to correct drainage issues within the ROW's of Sunrise Av., Oakland Blvd., and Round Hill Av. Construction is planned to begin at the end of FY 2020. This project will be using the Envision Rating System to improve community mobility and access, improve infrastructure integration, and manage stormwater.

    - FY 2020-2023 New projects without a previous Envision ranking will be evaluated via historical rankings and may be ranked using Envision.

- Existing — Stormwater staff is conducting a Green Streets Assessment to evaluate potential sites to incorporate this type of green infrastructure in major stormdrain capital improvement projects with the expectation of enhancing water quality prior to stormwater entering the traditional stormdrain system (See WMP Summary Table: Goal 1,D). Perspective locations include:

- The 1500 block of Main Street in the Wasena Area
- Campbell Ave. SW
- Forest Park Blvd.
- City of Roanoke's new Bus Station
- Templeton Road

- FY 2017-2023 – Stormwater will continue to work with the Planning Department to integrate green infrastructure projects downtown, especially in conjunction with Stormwater CIP Projects and the Downtown Plan 2017.

- Existing - Six Stormwater staff members are currently certified in the National Green Infrastructure Certification Program (NGICP). Thirteen additional City staff, including two members from Parks and Rec have completed the training during FY 2020.

    - FY2021 - Three additional Stormwater staff members became certified.

- FY 2020 - Stormwater created a Green Infrastructure team which will be responsible for the maintenance of City-owned BMPs, recent stream restoration projects, floodplain mitigation open space, and flood reduction projects throughout the City, as well as potentially constructing future Stormwater green infrastructure projects.

2.2.9 Water Quality Projects, Programs, and Initiatives

Primary TMDL Target: E. coli bacteria and Sediment

The following program plan will provide the foundation for all water quality-driven activities.

In FY 2015, the City created its initial TMDL Bacteria and Sediment Action Plan. The Action Plan is a working document and is an adaptive iterative process as new programs are created, data is collected and integrated into our BMPs. This plan outlines goals and the methods to achieve these milestones within a related timeframe. An updated version will be submitted in conjunction with the annual MS4 permit report on October 1 of each calendar year.

Implementation Schedule and Key Milestones:

Watershed Master Plans:

The City is consistently working on developing Roanoke River Tributary Master Plans. These Watershed Master Plans (WMP) will provide a finer level of detail to help the City prioritize the most effective strategies to meet the TMDL WLA requirements at various scales. Specific information is compiled on watershed characteristics, land use, imperviousness, topography, soils, and current water quality and streambank conditions in each watershed. Capital improvement projects, focused IDDE investigations, water quality monitoring data, and stormdrain maintenance problems will also be mapped to identify locations for installation of new and/or renovation of existing BMPs. Additionally, this data and its analysis will be formative in determining streambank restorations; BMP additions, BMP retrofits and strategic placement of manufactured BMPs to mitigate the impacts of stormwater runoff. Ultimately, the Watershed Master Plans will also facilitate communication with stakeholders in the protection, maintenance

and restoration of the watershed.

- FY 2015 - Lick Run WMP completed.
- FY 2016-2017 - Carvin Creek, Tinker Creek and Glade Creek WMP completed.
- FY 2017-2018 – Trout Run WMP completed.
- FY 2018-2019 – Peters Creek WMP completed.
- FY 2020- 2022 – Restructuring of WMP efforts to evaluate the cost/benefit ratio for all currently identified/proposed watershed projects Citywide. This effort will use the same watershed approach, but allow for comparison of all City watersheds based on key factors (e.g. soils, land cover, slope, etc.) and provide the tools to plan for water quality projects across all City watersheds.

Watershed Master Plan Goals, Strategies and Action Items

The long term goal is to have all watershed projects written up in a single document that would be updated every year with new information. This would allow Stormwater to evaluate work across all watersheds within the City limits. (see WMP Project Master List for more information)

Goal 1 – Maximize Watershed Resiliency and Sustainability

A. Restore more natural surface water processes
B. Revitalize ecosystem health
C. Augment capacity to endure and recover from short term hazards
D. Enhance adaptability to long term hazards

Goal 2 – Minimize Watershed Hazard to Public Health, Safety, and Property

A. Prioritize and construct capital improvement projects that both mitigate neighborhood flood hazards and improve downstream water quality.
B. Increase Community Rating System (CRS) ratings for progressive floodplain management activities
C. Delist from the 303(d) report all impairments including bacteria, sediment, Temperature and PCBs and Mercury in Fish

Goal 3 – Connect Citizens, Businesses, Students and other Stakeholders to their Watershed

A. Provide the community with life-long learning opportunities about their watershed
B. Engage the community in revitalizing watershed ecosystem health
C. Coach the community to participate in outdoor recreation and stewardship opportunities within their watershed.

Stormwater VSMP Design Manual Updates:

Watershed Master Plan Goals to include in the Stormwater VSMP Design Manual update:

- Incentivize infiltration practices (WMP Summary Table: Goal 1, A).
- Require new outfalls to discharge just below the riparian buffer and add diffusers/step pools for erosion reduction (WMP Summary Table: Goal 1, B).

- Use stream simulation method when replacing aging culverts (WMP Summary Table: Goal 2, A).

- Revise construction requirements for storm drain – sanitary sewer crossings to require encasing and minimum cover requirements (WMP Summary Table: Goal 2, C).

FY 2018 – The City, along with the VT Urban Stormwater Research engineers, conducted a review of other municipalities' stormwater design manuals and urban stormwater research. Information gathered was reviewed to see what recommendations would serve the City to encourage infiltration and green infrastructure practices for future private development requiring VSMP plan review.

FY 2020-2022 – The FY 2019 RFP process for revision of the current manual resulted in only one qualified vendor response and subsequent negotiation to achieve a mutually agreeable scope and fee were unsuccessful. During FY 2020-2021, a second RFP may be attempted with modified goals, funding, etc.

Zoning/Building Code Modification:

FY2018-2023 – Build consensus to:

- Allow for innovation green infrastructure/low-impact development (WMP Summary Table: Goal 1, D).

- Allow for green streets right-of-way cross section (WMP Summary Table: Goal 1, D).

Stream Restorations:

- FY 2019 - 2021– Lick Run Stream Restoration at Washington Park – The City received $150,000 in SLAF Grant funds (Stormwater Local Assistance Fund) in FY 2016. This project is approximately 700' in length with a total budget of $300,000 (See WMP Summary Table: Goal 1, A-C). A live webcam associated with the USGS water monitoring program is installed in Washington Park (See WMP Summary Table: Goal 3, A). Perennial plantings, a pedestrian bridge installation, and substantial completion of the project was completed in spring 2021 and additional planting is scheduled for Fall 2021.

- FY 2019 - 2020 - Lick Run Stream Restoration at Highland Farm - The City received $202,727 in SLAF Grant (Stormwater Local Assistance Fund) in FY 2017. This project is approximately 780' in length with a total budget of $405,455. As part of the project, a constructed wetland was built adjacent to the channel. Wetland Studies and Solutions was awarded the contract for this design-build project, with Shenandoah Streamworks sub-contracted for construction. Substantial completion to include plantings and minor grading is scheduled for spring 2020.

- FY 2020 - 2023 - Glade Creek Stream Restoration at Gus Nicks Blvd. East and West - The City received $986,700 in SLAF Grant (Stormwater Local Assistance Fund) in FY2017. This project is 2,950' in length with a total budget of $1,973,400. The project is currently scheduled for construction in fall 2022.

- FY 2020 - 2021- Lick Run Stream Restoration at the Roanoke Regional Airport - The City and Roanoke Regional Airport Commission have dedicated 50/50 funding for the completion of this project. Per the City ordinance Sec. 11.5-7, the Airport will receive a Utility credit equal to 1/7th of their financial contribution

for design/build of this project. This project was 1,700' in length with a total budget of $681,936. This project was completed in spring 2021.

- FY 2020 - 2023 - W. Fork Carvins Stream Restoration at the Roanoke Regional Airport - The City received $133,500 in SLAF Grant funds (Stormwater Local Assistance Fund) in FY 2021 and the Roanoke Regional Airport has dedicated 50% funding. Per the City ordinance Sec. 11.5-7, the Airport will receive a Utility credit equal to 1/7th of their financial contribution for design/build of this project. The project is 350' in length with a total budget of $267,000. Preliminary designs equivalent to 10% designs were created by Wetland Studies and Solutions for support in the fall 2020 grant application. Construction is planned for FY 2022.

- FY 2022-2023 - Trevino – Monterey Stream Stabilization Project – The City completed the stream restoration in FY 2018. A potential phase III to this project has been placed on a future project list as funding and capacity allows for completion.

- FY 2021 - The City submitted 4 SLAF Grant applications in FY20. The projects include a 350ft stream restoration, an outfall restoration, an extended detention pond, and the reforestation of a City park. Grants are currently under review, with DEQ staff scheduled to visit the project sites at a future 2020 date. Of the 4 SLAF Grant applications submitted in FY20, DEQ approved funding for the 350' W. Fork Carvins Stream Restoration.

- FY 2022-2024 - The City submitted 1 SLAF Grant application in FY 2022. The project submitted is an 1,800' stream restoration. If awarded, this SLAF project is planned for FY 2024.

Water Quality Monitoring Programs

USGS – COR Water Monitoring Program:

- Existing– The monitoring station site is located in the Lick Run Watershed adjacent to the greenway below Washington Park near the intersection of 2nd St. NE and Patton Ave. NE. The goal of this monitoring program is characterize streamflow and sediment transport in Lick Run prior to, during, and after BMPs are implemented throughout the watershed. The monitoring objectives include: continual stream levels, water temperature, pH, conductivity, dissolved oxygen, and turbidity. Data will also be used to determine annual loads of suspended sediment. All water quality and continuous flow data will be publically available on the USGS National Water Information System Website: https://waterdata.usgs.gov/nwis/inventory/?site_no=0205551460&agency_cd=USGS& (WMP Summary Table: Goal 3, A).

- Existing - Stormwater and USGS partnered to add additional gauges on the **Roanoke River at Rt 117**, **Roanoke River at Bennington St./13th St.**, **Tinker Creek at Columbia St**., and **Tinker Creek at Wise Ave in FY 2020**. Statistical relationships between sediment and turbidity will be developed at each of these stations in order to estimate real-time sediment loading, in addition to various other hydrology and water quality measurements. These gages will facilitate the targeting of sediment loads from City tributaries, and will provide extensive information that will provide science-driven watershed management in the City. More information is available at the USGS' Roanoke Project Site.

- Existing - Nine precipitation gauges were installed by USGS to monitor and report rainfall accumulations at

near-real-time through the City's service area. These rainfall data are used as input to models that will support watershed restoration efforts. Interpretive signage was installed at the Garden City Elementary School gauge site.

- FY 2019 – Stormwater partnered with VT Dept. of Civil and Environmental Engineering to create a public precipitation web app. Roanoke's Stream Hydrology And Rainfall Knowledge System (SHARKS) app displays a map interface featuring rainfall information and flood information.

Stream Biology Monitoring Program:

- Existing - The Citizen Science Water Monitoring Program began in spring 2017 and now has 43 certified monitors and one new additional certified trainer. The program has 31 monitoring sites and will continue to expand. The QAPP is approved by VA DEQ and a permit was secured through VDGIF. The City continues to work with Clean Valley Council (CVC) to coordinate the program. An interactive map showing monitoring locations and associated data is available to the public on the CVC website. (WMP Summary Table: Goal 3, A).

    - FY 2019-2023 - The Citizen Science Water Monitoring Program continues to recruit and certify volunteers twice a year. Training is conducted in the spring (March - May) and in the fall (September - November). Stream quality surveys are collected twice a year during the spring (March - April) and fall (October - November) sampling season. The program continues to grow and could expand to neighboring localities including the Town of Vinton, Roanoke County, and Salem if funding is identified.
    - FY2021 - During the COVID pandemic, the Roanoke River Project has been paused for most monitoring sites. Stormwater staff who are trained volunteers of the RRP have monitored some baseline sites and their normal monitoring sites. There were 15 sites that were monitored during the Fall 2020 season and 12 sites were monitored during the Spring 2021 season. It is undetermined at this time, when the program will be up and running at full capacity again. There have been two virtual trainings offered to help keep monitoring and identification skills fresh.

- FY 2019-2023 - The VSCI Stream Monitoring Program monitors 20 strategic sites in the City. Monitoring is conducted by a professional biologist twice a year during the spring (March - April) and the fall (October - November) sampling season. Stream flow, habitat and water quality measurements are also collected as part of this work, as ambient conditions can affect the benthic community.

Bacteria Monitoring:

- Existing - The City's in-house Bacteria Monitoring Program began in April 2017 and aims to establish baseline bacteria levels and help to identify and locate bacteria sources found in city streams.

    - Existing — Stormwater transitioned to its level III bacteria monitoring program using the Colilert Test by IDEXX in April 2018. James Beckley reviewed staff technique, QAPP, and level III program details in May 2018. The Level III QAPP has been signed by all parties. Samples are collected from approximately 40 sites across the City per month.

- Existing — In December 2018, the City began a partnership with Hampton Roads Sanitation District (HRSD) to sample for HF183 a human marker as part of a source-tracking program to determine sources of bacteria. Sampling is scheduled based on average *E.coli* levels, accessibility, and WVWA or Stormwater construction.

The goal is to find all inputs of human marker into that particular stream or stormdrain system section and work to trace them to a fixable source. Sampling at other locations throughout each watershed and in the MS4 is based on new information from CCTV crews, field observations, or new events.

- FY20-21 - The capacity to work with Hampton Roads Sanitation District (HRSD) to monitor for HB 183 has been put on hold due to the continuing COVID pandemic. HRSD currently does not have the ability to do additional work for other municipalities as they continue to focus on monitoring COVID in wastewater sources in their community. Stormwater staff are seeking alternative and affordable labs to continue the City's work on HB 183.

2.3 PUBLIC EDUCATION AND OUTREACH

2.3.1 Printed Educational Materials

Outreach materials utilized and implementation plans can be found in the MS4 Program Plan 2018-2023 section 1.2 (page 9). All MCM #1 outreach is outlined in pages 6-16.

Primary TMDL Target: E. coli bacteria and Sediment

Implementation Schedule and Key Milestones:

- Existing - The City has created Erosion and Sediment brochures highlighting stormwater best management practices for both citizens and contractors. The citizen brochure will target homeowners and the contractor brochure will target: 1. Contractors involved in soil disturbing activities that are under the threshold required to obtain a Virginia Stormwater Management Program (VSMP) permit or generate a Stormwater Pollution Prevention Plan (SWPPP); and 2. Contractors not involved in soil disturbing activities, but who otherwise have a potential to affect water quality via runoff and/or improper materials and waste management. The citizen brochure, as well as other stormwater related educational material, will be available at Stormwater Division presentations, available for mailings, and at the City's permit office.

- FY2020 - 2023 - Stormwater created a new annual publication, The State of our Waters, that summarizes water quality data, outlines what actions the City has taken to reduce pollutants and lets citizens know how they can help improve water quality. The publication also includes updates on stormwater projects and maintenance. This publication was mailed via USPS to all 39K+ Stormwater Utility customers. The publication was also distributed to libraries, coffee shops, outdoor education centers, the Municipal building lounge and at other outreach events.

2.3.2 Partnership with Clean Valley Council

Primary TMDL Target: All pollutants including E. coli bacteria and Sediment

The City and surrounding localities have contracted with the local non-profit, Clean Valley Council (CVC), to provide events and programming that educate Roanoke Valley citizens about litter prevention, recycling, conservation, and protecting natural resources.

Implementation Schedule and Key Milestones:

- Existing - The CVC currently reaches the City's population through education and public events. Through its stream and in-school education programs, the CVC provides environmental literacy to students throughout the Roanoke Valley. Environmental literacy is an important foundation promoting stewardship and an environmental ethic to complement the City's outreach program of engaging and inspiring citizens to make appropriate behavior changes today and create a cultural shift tomorrow.
- FY 2020-2023 – The City continues to build its relationship with CVC working together on community events, outreach programs and projects including the Citizen Science Water Monitoring Program, Adopt-A-Street, Habitat for Humanity, and Star City Sustainability Society. Events include the Recycled Regatta, Go Fest, Earth Day, and rain barrel workshops.

- FY 2021 - Share watershed master plans with Clean Valley Council to be published on the CVC website and used for existing school education program enhancement (WMP Summary Table: Goal 3, A).

    - FY 2022 CVC is undergoing a website revision and will work to include this information.

2.3.3 Collaboration with External Organizations/Groups

Primary TMDL Target: E. coli bacteria and Sediment

The City is working with various civic organizations to increase audience reach and citizen participation as well as maximize results through increased environmental literacy and collaborative opportunities. The City intends to provide giveaways at these events that are TMDL target specific and relevant to the activity. Examples would be pet waste bag dispensers with printed clean water messaging.

Implementation Schedule and Key Milestones:

- FY 2015 - FY 2023 –CVC's Recycle Regatta – Stormwater has an outreach booth and actively talks with citizens using the greenway and gives away pet waste bag dispensers to citizens with dogs. Stormwater competes in the Recycled Regatta with a boat made out of recycled "rain barrels". The boat sail includes a "Scoop the Poop" or other water quality message.
    - FY21 – boat race cancelled but event otherwise held with an outreach booth.

- FY 2015-FY 2023 – Roanoke Valley SPCA Tail Chaser – An estimated 250 race participants receive a waste bag holder with starter bags donated by Stormwater for their dog's leash so owners are "never" without a bag.
    - FY20-21 Due to COVID-19 the event was moved to a virtual/ individual event. Pet waste bags are still provided as needed.

- FY 2018 - FY 2023 Rain barrel workshops are organized by CVC throughout the year and are offered in different areas of the City.

    - FY2020 - Stormwater plans to host a rain barrel workshop for City employees. This was postponed until further notice due to COVID-19.

- FY 2020 - 2023 - The City's Stormwater Utility, supported by Motivf, a consulting firm, will begin a marketing campaign focused upon engaging stakeholders and learning more about how citizens interact with Roanoke's waterways - the River and its 13 tributaries. This work will culminate with a pilot campaign

inspired by those stakeholders and citizens. Rather than implementing a marketing campaign based on assumptions about Roanoke's population and attitudes, this Clean Water Legacy marketing campaign will be a long-term process of engaging these water quality stakeholders.

- FY 2019 - FY 2021 - Educational events hosted with Big Brothers Big Sisters local chapter for children, grades 3-6, 1-2 times per year. This includes demonstrations of watershed models, litter messaging design contests, book readings, and examples of stream sampling in local creeks to increase water quality knowledge for local children facing adversity in their homes.
    - FY22 - Events will continue based on availability due to COVID-19.
- FY 2018 - 2023 - The City's Stormwater Utility provides pet waste bag dispensers to the Greenway Ambassador volunteers who distribute to pet owners as needed when walking the greenways.

Watershed Stewards Academy (WMP Summary Table: Goal 3, A-C):

In order to create a positive change to ultimately protect and repair watersheds, we must engage citizens through active learning and participation; thus increasing social capacity for an environmental culture shift within the Roanoke Valley. This program concept should be a collaborative effort among existing groups like CVC, URRR, RVARC and local governments. Ideally, this program would form a new branch of an existing program like CVC or URRR. This program must have a dedicated paid staff member.

FY – 2020 -- Until one of the local non-profits is ready to take on the program, the City's Stormwater Utility is working with the City's Sustainability Outreach Coordinator to develop a Leadership Green Academy, which is an advanced track compared to the existing Green Academy held annually. Theadvanced course will have sessions geared towards water quality with capstone projects focusing on improving theupper Roanoke River watershed.

FY 2021-22 – The City's Stormwater Utility is working with Motivf to develop and test a local Watershed Steward Academy sponsored by the City.

2.3.4 Collaboration with Internal City Departments and Divisions

Primary TMDL Target: E. coli bacteria and Sediment

The City continues to work through what are often conflicting interests to achieve our TMDL WLAs while meeting and managing other pressing economic, social, and environmental needs. Internal partnerships and interdepartmental collaboration is essential to find solutions that benefit all stakeholders.

Implementation Schedule and Key Milestones:

- FY 2021-FY2023 – Inlet Art Project - Interdepartmental collaboration with the City Art and Culture Coordinator to commission works of art that would illustrate and/or draw attention to stormwater. One successful launch of the project was completed in 2018 with 6 inlets painted by local artists. The City also donated paint and Supplies to Woodrow Wilson Middle School in 2019 for students to complete an inlet art project with clean water messaging. The City plans to repeat the inlet art project roughly every 2 years, 2021 saw another 6 inlets completed in new areas of the City.

- FY 2021 – Interdepartmental collaboration with City Art and Culture Coordinator to hold a jingle competition about reducing cigarette butt litter in the downtown central business district. Local musicians

competed for downtown gift certificates, 5 winners and 2 honorable mentions were selected. Jingles were used to promote 20 new cigarette butt receptacles installed downtown.

- Future – Artful Rainwater Design – Interdepartmental collaboration with the City Art and Culture Coordinator to commission works of art that would illustrate and/or draw attention to stormwater. Grant funding may be available through the National Endowment for the Arts and/or the Virginia Commission of the Arts. Project ideas may include a Rainwater Trail that highlights underground streams or a water project highlighting Roanoke's Sister Cities.

- FY 2019-2020 – The City's Stormwater Utility and Planning Department staff is coordinating draft priorities and policies for the Comprehensive Plan. Plan is in phase 4 out of 6 and moves to the Planning Commission and then City Council for approval in spring 2020. Approval was delayed by COVID-19 and the process was moved to fall 2021.
- Existing - Collaboration with the Parks and Recreation Department for Mutt Mitt Station installation and maintenance and annual tree planting projects in selected watersheds (See section 2.2.7 for additional information).

- Existing - Collaboration with the City's Animal Control Unit, the Police Department's Paw Patrol, and Downtown Roanoke Inc. (DRI) to educate and engage dog owners living in the downtown areas.

- Existing – Illicit discharge of Grease in CBD – Collaboration among Solid Waste, Stormwater, DRI, Inc., and Office of Environmental Management to determine what actionable steps should be taken as a City to solve this ongoing issue.
    - FY 2020 – Stormwater partnered with City Fire Marshal's to distribute FOG brochures during inspections and as issues arise. Stormwater supplied the department with 200 brochures and will keep their supplies stocked as needed. Stormwater plans to mail the FOG brochure to new City restaurants only.
    - FY2021 – the Fire Marshall's office distributed approximately 150 brochures to restaurants.

2.3.5 Other Targeted Projects, Programs, and Initiatives

Primary TMDL Target: E. coli bacteria and Sediment

The City plans to implement the following bacteria specific projects, programs, and initiatives to maximize community education, engagement, and inspiration to create change for improved water quality.

Implementation Schedule and Key Milestones:

Pet Waste Campaign Program (WMP Summary Table: Goal 3, B-C):

- Existing - The City has successfully worked with the Mill Mountain Garden Club to use grant money to design and create signage for installation above Mutt Mitt Stations. These signs are installed above Mutt Mitt stations across the City. Additionally, the MMGC created yard signs with pet waste messaging for citizens. Stormwater continues to outreach to pet owners with materials referenced in the Program Plan and in the sections above.

- Existing– Created a pet waste video that was used in conjunction with the neighborhood sign program. The

video was sent out to social media, Next Door, and is shown prior to the Movies in the Market on in the summer. Stormwater plans to continue making short videos in partnership with RVTV with water quality messages to play before Movies in the Market each summer.

- Existing – Stormwater purchases a much more durable, pet waste bag dispenser with biodegradable bags for handing out to the public with the branded sticker "Do Your Doody While You Move Your Booty".
    - FY 2021 - <100 pet waste bag dispensers were handed out to the public. (*number lower due to COVID-19)

- FY 2019 – Stormwater collaborated with DRI and PooPrints to promote dog registration day downtown. The Pooprint Program was started by Apartment owners and DRI to register downtown residential dogs. Dog owners will be fined if DNA testing reveals the owner left pet waste on the ground. While DRI manages the program, Stormwater will continue to promote the program as needed.

Septic System Outreach:

- FY 2019 - 2023 – Septic Clean-Out/Repair and Sewer Connection – The City and other stakeholders will be developing a strategy to address septic repairs/replacement and/or sewer hook-ups. Partnerships for this effort may include local MS4s, Virginia Department of Health, Soil and Water Conservation Districts, and others to identify and target failing septic systems as well as identify and promote funding sources for homeowner resolution.
    - Existing – A septic outreach direct mailer was designed using the EPA septic smart brochure template and is directly mailed to known or suspected septic system owners each year during septic week in September.
        - FY 2020 - The City is working with the WVWA and its GIS staff to update the septic system mailing list to ensure the 423 properties are the most accurate and up to date information.
        - FY 2021 - The City updated septic system records using GIS and feedback from citizens to create a new list of estimated septic systems totaling 1828.
    - Existing – The City continues to provide commitment and support to the WVWA for the projects that will be implemented with 319 Grant funds for sanitary sewer hookups in areas with known septic failure in the subwatersheds of Glade Creek and Mudlick Creek.
        - FY – 21 Progress has begun for Glade resulting in 11 of 13 potential homes in the first block of Richard Ave connecting to sewer from septic. An additional 19 residents will be approached about connecting in FY22 on the next block of Richard Ave in Glade creek watershed. No connections have been made in the Mudlick creek watershed to date.

- FY 2021-2022 - An updated City Ordinance related to Septic systems draft was developed by the City's StormwaterUtility and the City's Planning Department. With City Administration approval, the updated Ordinance mayrequire parcel owners with septic systems to pump septic tanks at least once every five years and send in documentation to the City. Additionally, the updated Ordinance may require parcel owners to register septic system upgrades and/or replacements if necessary, and under certain conditions, connect to sanitarysewer if there is septic system failure.
    - FY21 – City Administration is considering the merits of implementing the proposed ordinance.

2.4 CITY EMPLOYEE TRAINING

2.4.1 MS4 Permit Stormwater Pollution Prevention Training

Primary TMDL Target: Illegal discharge of sediment, chemical pollutants, and bacteria sources

The City's video-based stormwater pollution prevention training educates all employees about IDDE and emphasizes action by instilling the phrase, "If you see something, say something". Additional training focuses on general stormwater BMPs and departmentally relevant material.

Implementation Schedule and Key Milestones:

- FY2019 The City completed training in person.
    - FY 2021 - The City completed training with a combination of virtual and in-person sessions due to COVID-19.
- FY 2018- 2023 - Work towards better integration with Roanoke City Public Schools (RCPS).
    - FY2019 – The City has shared access with RCPS for full viewing of the Rain Check and IDDE training videos to train applicable personnel.
    - FY2020 - Increased coordination with Jeffery Shawver to promote focus on MS4 maintenance at schools.
    - FY 2021-2022 - Look at RCPS's stormwater BMPs for retrofit opportunities.

2.4.2 Stormwater & Environmental Awareness Training for New, Full-Time Employees

Primary TMDL Target: Illegal discharge of sediment, chemical pollutants, and bacterial

The City provides a multi-day New Employee orientation that includes an overview of Federal Laws including: RCRA, CERCLA, SARA, FIFRA, CAA, and CWA. The training describes the purpose of the City's Environmental Sustainability Management System and every employee's legal responsibility and role in compliance. The training covers reportable quantities, safety features such as "rule of thumb", and the Anonymous Hotline and Ethics Point website for reporting environmental issues.

Implementation Schedule and Key Milestones:

- Existing – This recurring training is held every other month for all new City employees. Stormwater collaborated with RVTC on a new Stormwater video to be used at new employee training and public awareness.

2.4.3 Specific Operational and BMP Training

Primary TMDL Target: Sediment, Solid Waste, Petroleum products, and Bacteria

The City focused on high risk operations, mainly at our Public Works Service Center, to create and implement a series of Standard Operating Procedures and related training designed to minimize the potential for stormwater pollution

and educate employees to respond appropriately in case of a spill or other release. Examples include: Bulk Fuel Delivery, Vehicle & Equipment Fueling, Parking lot sweeping, Hydraulic fitting storage, and more. One related advantage is that these operational BMPs are deployed City-wide as Public Works employees conduct their jobs throughout our community.

Implementation Schedule and Key Milestones:

- Existing – This training is on-going with refreshers on a rotational basis or as dictated by operation and/or equipment changes.

2.4.4 Stormwater Management Certification for Applicable Inspectors

Primary TMDL Target: E. coli Bacteria and Sediment

City Development Inspectors in the Planning Department as well as City Stormwater Engineers, who conduct post construction BMP inspections on publicly-owned stormwater management facilities, must become certified as stormwater management inspectors. This course includes best practices and responsibilities of a stormwater inspector during and after construction as well as the Stormwater Management Act, Virginia Stormwater Management Regulations, Construction General Permit Regulation, and the 15 non-proprietary BMPs.

Implementation Schedule and Key Milestones:

- Existing – New Inspectors must become SWM certified within their first year of employment.
    - Existing - Michael Venable, Joseph Judy, Indra Altangerel, and Cyndi Sledd (Stormwater) are certified and inspect public BMPs.
- Existing – Inspectors are required to maintain certification by earning 18 CEU credits every 3 years (per Water Guidance Memo # 15-2002)
- TBD – Other City inspectors and/or employees may also be required to obtain SWM certification.

2.4.5 E&S Certification for Applicable Inspectors

Primary TMDL Target: Sediment

City Development Inspectors must become certified as E&S Inspectors. General knowledge areas include: Virginia Erosion and Sediment Control Laws and Regulations, elements of basic erosion and sediment control, plan reading and interpretation, and calculation methods related to specifications of slope, seeding rates, etc.

Implementation Schedule and Key Milestones:

- Existing – New Inspectors must become E&S certified within their first year of employment.
    - Existing - William Shepherd, Indra Altangerel, Cyndi Sledd and Michael Venable (Stormwater) are E&S certified.
- Existing – Inspectors are required to maintain certification by earning 18 CEU credits every 3 years (per Water Guidance Memo # 15-2002)
- TBD – Other City inspectors and/or employees may also be required to obtain E&S certification

SECTION 3: ACTION PLAN ASSESSMENT AND IMPROVEMENT

3.1 METHOD FOR ACTION PLAN ASSESSMENT

This section attempts to provide a comprehensive list of the City's plans and procedures; however, it is important to note that some plans are developed more fully than others, while some plans are existing and on-going. Further, the City will continue working in coordination with neighboring MS4s and others to develop mutually beneficial performance metrics and analysis procedures that will be used to help us collectively develop and report meaningful, high quality results aimed at supporting delisting decisions. The assessment measures on the following pages will therefore become increasingly refined and clarified in future Action Plan iterations.

The City of Roanoke intends to address the pollutants of concern (POC) through a multi-pronged approach. Initially, an in-stream water quality monitoring approach is being used with program expansion and collaboration with USGS to monitor total suspended solids (TSS) in selected sediment-impaired streams.

The City in partnership with CVC, runs a citizen science benthic macroinvertebrate water monitoring program. The goal is to add about 40 monitoring sites throughout the City. Benthic macroinvertebrate sampling will be completed 2 times/year. Other basic monitoring data, like temperature, turbidity, DO, and pH will be collected at designated sites. We are also pleased to include that the Citizen Science Water Monitoring Program data will be stored and available to City of Roanoke staff, local students, and the general public in an online interactive mapping format that will allow for ease of interpretation and application. Ultimately, this database may include any VSCI monitoring results completed by the City and through the Citizen Science Program. The City's bacteria monitoring program has achieved level III status and the collaborative partnership with Hampton Roads Sanitation District to monitor using HF183 or human marker and both are useful tools in source tracking. The partnership with USGS for long-term continual monitoring on selected streams, including Tinker Creek, Lick Run, & the Roanoke River, will further assist in watershed characterization and developing an understanding of sediment transport and streamflow. As the City brings all of these pieces together, we can then move towards developing a modeling approach for measuring TMDL AP effectiveness.

Further, our Watershed Master Plans (see WMP Summary Table) with Goals, Objectives, Action Items, and Indicators are integrated into our Action Plans. Completing Action Items outlined in the summary table will serve as additional indicator matrices.

3.2 OVERALL GOALS AND DISCUSSION

The goals of this Action Plan are intended to provide a framework for the City to coordinate its activities, optimize stormwater BMPs and influence behavior change to reduce anthropogenic-source bacteria and sediment in order to meet the City's WLAs. A successful, collaborative effort among the City, other regional localities and adjoining MS4s, academic research, civic groups, and non-profits will be required to restore health to the Upper Roanoke River and all of its tributary watersheds.

The City plans to use a watershed approach to achieve the TMDL WLAs and ultimately delist the Roanoke River and its tributaries. Goals of this approach are as follows:

- Maximize resiliency & sustainability of both natural surface water processes (abiotic hydrology & morphology) and ecosystem health (biotic species habitat & diversity) to ensure both recovery from short term hazards (drought & flood) and adaptability to long term events (climate change.)

- Enrich the community by connecting Citizens to their watershed through education about natural surface water processes and engaging them to protect/restore the aquatic and floodplain habitat, species biodiversity, ecosystem health, and outdoor recreation opportunities in their neighborhood.

- Protect public health and safety through FEMA recognized community floodplain management activities including public information and education, mapping and sustainable development regulations, flood damage reduction, and warning & response.

This watershed ideology will maximize the City's natural resource assets; protect and/or restore watershed ecosystems; and preserve a high quality of life for Roanoke citizens. Ultimately, we believe that the collaborative approach between the City and its citizens to "Be part of the solution, not the pollution" today will create a "Clean Water Legacy".

New data is and will be collected during the creation of each tributary Watershed Master Plan. This new data will allow for prioritization and optimization of both design and location of stormwater BMP retrofits and/or new stormwater BMPs. Prioritization of water quality projects is based on the estimated sediment load reduction and potential for flood mitigation compared to an estimated life cycle cost for the project. Sediment load reduction calculations use the Virginia Runoff Reduction Method with a total suspended solids event mean concentration to estimate loading. Load reduction is based on percent removal values from the Chesapeake Bay Program and stream restoration benefit is based on Expert Panel load reduction per linear foot. Project costs use cost per treatment volume data from Hodges (2016) and cost per linear foot data for stream restoration projects.

Finally, as part of this Action Plan, a spreadsheet is included that details the City's prioritization of BMP types, targeted watersheds, and possible funding schedule. Progress and implementation will be reported in the City's Annual MS4 Report and the Action Plan will be refined as more complete information becomes available.

Using current data, the City of Roanoke estimates the assigned WLAs will be achieved in 2089 through completed WMP projects & planned CIP Drainage projects using the current Stormwater Utility fee structure. Since 2013, the Stormwater Utility has completed 31 drainage projects valued at over $16.1 M. The table below outlines the current estimates to achieve the WLAs to delist the 303(d) list impaired streams.

2018-2023 Sediment and Bacteria TMDL Action Plan Completion Plan	
Citywide estimate for entire City WMP projects	$+/-160 M
Current estimate for +/- 215 CIP Drainage project backlog	$+/-140 M
Est. Capital/year including Cash, Bond, Grants (Utility fee & Debt Service)	$+/- 5 M
Estimated 70 years or 2091 ETA for completion of identified WMP needs & CIP Drainage projects	

This is just an estimate of the financial commitment and projects it will take to achieve the assigned waste load allocations; however, the actual amount of time that will be needed in the future to implement BMPs is unknown. Watersheds and their associated surface water bodies are complex biological systems that do not react uniformly to implementation efforts.

Further, if there are unforeseen difficulties in the future that reduce available funding or delay on-the-ground construction of best management practices (BMPs) or programmatic work, the City of Roanoke may be facing a longer implementation schedule. Additional uncertainties include assigned sediment waste load allocations vs. what habitat requirements it will take to achieve adequate suitable habitat, lack of knowledge of specific BMP efficiencies for various pollutants, and unknown precipitation quantity and intensity changes due to climate change.